

[Translation]

LAID-OPEN PATENT APPLICATION

Laid-open patent application number: Hei-6-18777

Date laid-open: January 28, 1994

Int. Cl.

G02B 7/73 7/09

G03B 13/36

Classification mark / Office filing number: FI

9119-2K

G02B 7/11 B

7/04 A

Examination requested: Yes

Number of patent claim: 1

(4 pages)

[Continued to last page]

Patent application number: Hei-5-65210

Indication of division: Division of Sho-61-66553

Date of application: March 24, 1986

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[TITLE OF INVENTION] CAMERA

[SUMMARY]

[Object] It is the object of the invention to miniaturize camera body by securing inside lens barrel a space necessary for containing parts to be contained inside lens barrel while preventing lens barrel from becoming larger.

[Construction] In a camera having a lens barrel 9 capable of advancing and retreating along the optical axis of the photographic lens 1, the central axis extending toward the advancing and retreating direction of the lens barrel 9 is decentered in respect of the optical axis of the photographic lens 1. Parts to be contained inside the lens barrel such as the distance metering optical system 30 are contained in the space expanded as result of decentering.

32

Condenser lens

34

Projector lens

9

Lens barrel

[PATENT CLAIM]

[Claim 1] A camera having a lens barrel capable of advancing and retreating along the optical axis of a photographic lens, wherein the central axis extending toward the advancing and retreating direction of the lens barrel is decentered in respect of the optical axis of the photographic lens.

[Detailed explanation of the invention]

[0001]

[Industrial application of the invention] The present invention relates to a camera having a lens barrel capable of advancing and retreating to the direction of the optical axis of the photographic lens.

[0002]

[Conventional technology] In a conventional camera of this type, a variable focus camera is known wherein the focal length of the photographic lens is changed by changing the extent of extension of the lens barrel in respect of the camera body. In such a variable focus camera, it is so arranged as to make the optical axis of the photographic lens coincide with the central axis of the lens barrel, and parts to be contained inside the lens barrel, such as a diaphragm/shutter or an actuator for focus adjusting mechanism, are contained in the spacing between the outer periphery of the photographic lens and the inner periphery of the lens barrel.

[0003]

[Problems which the present invention intends to solve] In the above-mentioned type of camera, the diameter of the lens barrel has to be made larger in order to expand the space to contain parts to be contained inside the lens barrel; however, the parts to be contained inside the lens barrel are arranged only at a specific position on the outer periphery of the photographic lens; and accordingly, the diameter of the lens barrel has to be made larger only for some parts to be contained inside the lens barrel, and this creates an unnecessary space at positions

where parts to be contained inside the lens barrel are not to be contained. As the lens barrel becomes larger, the enlargement of the drive mechanism for advancing and retreating it to the direction of the optical axis of the photographic lens can not be prevented, and this becomes a great obstacle for making camera body compact.

[0004] It is the object of the present invention to provide a camera wherein the camera body can be made compact by securing inside lens barrel a space necessary for containing parts to be contained inside lens barrel while preventing lens barrel from becoming larger.

[0005]

[Means to solve problems] Explanation will now be made in reference to Fig. 1 showing an example of embodiment. The present invention is applied to a camera having a lens barrel 9 capable of advancing and retreating along the optical axis of the photographic lens 1. And the above-mentioned object can be achieved by decentering the central axis extending to the advancing and retreating direction of the lens barrel 9 in respect of the optical axis of the photographic lens 1.

[0006]

[Operation] A large space suitable for containing the parts 30 to be contained inside the lens barrel can be provided on the side of the decentered direction of the central axis of the lens barrel 9 without enlarging the lens barrel 9.

[0007] Incidentally, in the foregoing paragraphs (Means to solve problems and Operation), an illustration of an embodiment is shown in order to facilitate understanding of the present invention; however, the present invention is not thereby restricted to such example of embodiment.

[0008]

[Example of embodiment] Explanation will now be made of one example of embodiment of the present invention by referring to Fig. 1 to Fig. 4. Fig. 1 to Fig. 4 show one embodiment of the present invention. In Fig. 1 showing a vertical section of the

lens barrel portion, the principal lens 1 made of 3 groups is retained by a retainer barrel 3 wherein a helicoid screw 3a is provided/carved on the outer peripheral part thereof, and the retainer barrel 3 is screwed to the helicoid 51 of the shutter baseboard 5. The shutter baseboard 5 retains the shutter 7 at the rear part 52 of the principal lens 1, and the distance metering optical system 30 to be referred to later is arranged in the retainer member 53 at the upward portion of the principal lens 1.

[0009] Inside the tubular shaped lens barrel 9, the shutter baseboard 5 is fixed in unison therewith, and the helicoid screw 91 which is provided/carved on the outer periphery of the lens barrel 9 meshes with the helicoid screw 111 of the lens barrel transport tube 11 arranged on the outer periphery of the lens barrel 9. The rotation of the lens barrel 9 itself is prevented by a rotation prevention member provided on the camera body (not illustrated), while its movement to the direction of the optical axis is made free, and consequently, as the lens barrel transport tube 11 rotates, the lens barrel 9 moves along the optical axis in association therewith. In other words, movement takes place between the retreated position in short focal length photographic mode (Fig. 1) and the extended position in long focal length photographic mode (Fig. 2). Incidentally, 10 shows a cover.

[0010] There is also provided a coupler ring 13, rotationally movable around the optical axis of the principal lens 1, on the outside of the tubular part 54 of the shutter baseboard 5 on which the retainer barrel 3 is screwed. As shown in Fig. 4, a motor 15 having a gear 151 meshing with the gear 131 formed on the coupler ring 13 is retained by the shutter baseboard 5. Furthermore, a tubular cam 132 is provided on and in association with the coupler ring 13.

[0011] In Fig. 4, the cam follower 171 of the lever 17, made rotationally movable around the rotation center O1 is engaged with the cam 132. At the other end of the lever 17, there is

provided a pin 172 which made to engage with the engagement part 191 of the lever 19 made rotationally movable around the rotation center O2. Here, the coupler ring 13, motor 15, levers 17 and 19 comprise a scanning means 40. Also, the coupler ring 13 has an engagement arm 133 provided in protrusion to the forward direction of the camera, and as shown in Fig. 3, it engages with the engagement arm 211 of the back adjustment ring 21 screwed onto the front plane 3b of the retainer barrel 3, and the rotation of the motor 15 is conveyed to the retainer barrel 3 via the coupler ring 13. The coupler ring 13, motor 15, and back adjustment ring 21 comprise the drive means 50 of the photographic optical system.

[0012] As illustrated in Fig. 1 and Fig. 4, the distance metering optical system 30 is comprised of a light receptor sensor 31 fixed on and retained by the shutter baseboard 5, a condenser lens 32 which condenses reflected light onto the light receptor sensor 31 as will be explained later, a light emitter element 33 fixed onto one end of the lever 19 and a projector lens 34 which projects the exit light from the light emitter element 33 to the direction of a photographic object. As shown in Fig. 3, the condenser lens 32 and the projector lens 34 have a pair of cutouts 32a and 34a on the periphery thereof respectively in parallel. Installation of these cutouts 32a and 34a is helpful in making the retainer member 53 small and enlargement of the diameter of the lens barrel 9 is thereby restrained. In Fig. 4, incidentally, the condenser lens 32 and the projector lens 34 are illustrated in a round shape for sake of simplification.

[0013] Also, as will be clear from Fig. 1 and Fig. 3, the principal lens 1 is mounted with its optical axis downwardly decentered from the central axis of the lens barrel 9. This is helpful in expanding the space for containing the distance metering optical system 30 while preventing increase of the diameter of the lens barrel 9. And the light receptor sensor 31 and the light emitter element 33 are connected to the automatic focus detection circuit 41, the light emitter element 33 is so controlled as to emit

modulated light and distance metering is performed according to the output signal of the light receptor sensor 31.

This detection circuit 41 is connected to the computation processing unit 42 (referred to as "CPU" hereunder), which is connected to the motor drive circuit 43 for controlling the motor 15. Incidentally, the electrical elements of this detection circuit 41, CPU 42, and motor drive circuit 43 are also retained in unison on the shutter baseboard 5.

[0014] The operation of the embodiment thus constructed will now be explained. In short focal length photography, as shown in Fig. 1, the lens barrel 9 is in its recessed position inside the lens barrel transport tube 11, and the focal length is determined by the principal lens 1. As the shutter button (not illustrated) is half-depressed, the motor drive circuit 43 starts working according to a command from the CPU 42, the motor 15 starts its rotation and the light emitter element 33 emits modulated light by way of the detection circuit 41. In Fig. 4, as the motor 15 rotates to the counterclockwise direction, the coupler ring 13 rotates to the clockwise direction and the lever 17 rotates to the counterclockwise direction. As the lever 19 rotationally moves to the clockwise direction in association with the lever 17, the light emitter element 33 also rotationally moves to the clockwise direction, and the photographic object is scanned with modulated light via the light projector lens 34. And the rotation of the motor 15 is conveyed to the back adjustment ring 21 via the engagement arms 133 and 211, the retainer barrel 3 rotates and this causes the principal lens 1 to be extended against the shutter baseboard 5.

[0015] The modulated light projected onto the photographic object is reflected and enters the bi-sectional light receptor sensor 31 via the condenser lens 32. The output from each of the pair of light receptor sensor 31 enters the detection circuit 41, where the signal is processed according to a known method, and the point where the output from each of the light receptor sensor 31 coincides is judged as an in-focus point and a judgment

signal is output to the CPU 42. Thereafter, a motor stop signal is output from the CPU to the motor drive circuit 43 and the motor 15 is stopped. Thus, the extension of the retainer barrel 3 is stopped and the principal lens 1 is controlled and comes into focus according to the distance to the photographic object.

[0016] In succession, according to a drive means (not illustrated), the lens barrel transport tube 11 with the rotating lens barrel 9 is extended to the camera's forward direction along the optical axis, a secondary lens 23 is inserted to the rear optical axis of the principal lens 1, thus enabling long focal length photography as illustrated in Fig. 2. As is clear from Fig. 2, the drive means 50, comprising the principal lens 1 comprising the photographic optical system, the distance metering optical system 30, the scanning means 40 and the motor 15, moves forward in unison, in association with the extension of the lens barrel 9, and hence the relative positional relationship among these elements and systems do not change. In long focal length photography, also, distance metering and focus adjustment are likewise performed as in short focal length photography. In either case of short focal length photography or long focal length photography, it is so optically designed that the amount of extension of the principal lens 1 remains the same in respect of the distance of photography. Consequently, the same cam can be used.

[0017] As has been explained above, according to this embodiment, a necessary space for containing the distance metering optical system 30 is secured inside the lens barrel 9 by decentering the lens barrel 9, the lens barrel can be made compact, in comparison with the conventional example where the lens barrel 9 and the principal lens 1 are brought onto the same axis. As a result of this, the mechanism for advancing and retreating the lens barrel 9 to the direction of the optical axis of the principal lens 1 can also be made compact, and this further makes it possible to make camera body compact.

[0018] According to this embodiment, the distance metering

optical system 30 is contained in the space which is expanded in association with the decentering of the optical axis of the principal lens 1 from the central axis of the lens barrel 9; however, the present invention is not restricted to this embodiment. In case where the distance metering optical system 30 is not to be contained inside the lens barrel 9, other parts to be contained inside the lens barrel, such as the shutter baseboard 5 for example, may be contained inside the space expanded as result of decentering. The present invention can be applied not only in a bifocal length camera, but in a single-focal length camera or three- or more focal length camera, as long as the lens barrel advances and retreats.

[0019]

[Benefits of invention] According to the present invention, as has been explained so far, the central axis of the lens barrel is decentered in respect of the optical axis of the photographic lens, and consequently the camera body can be made compact by securing inside lens barrel a space necessary for containing parts to be contained inside lens barrel while preventing lens barrel from becoming larger.

[Brief explanation of the drawings]

[Fig. 1] Vertical sectional drawing of the front part of the lens barrel in short focal length mode in a camera in one example of embodiment of the present invention.

[Fig. 2] Vertical sectional drawing of the front part of the lens barrel in long focal length mode in a camera in one example of embodiment of the present invention.

[Fig. 3] From view of Fig. 1 seen from the line III-III.

[Fig. 4] Drawing of the periphery of the distance metering optical system 30, including a block diagram of the focal length detection control system.

[Explanation of the reference marks]

- 1 Principal lens
- 3 Retainer barrel
- 5 Shutter baseboard

9 Lens barrel
11 Lens barrel transport tube
13 Coupler ring
21 Back adjustment ring
30 Distance metering optical system
31 Light emitter element
33 Light receptor sensor
40 Canning means
50 Drive means

[Fig. 1]

11
Lens barrel transport tube

9
Lens barrel

30
Distance metering optical system

31 (33)
Light receptor sensor
Light emitter element

40
Scanning means

1
Principal lens (photographic optical system)

3
Retainer barrel

13

Coupler ring

5

Shutter baseboard

21

Back adjustment ring

50

Drive means

[Fig. 2]

23

Secondary lens

[Fig. 3]

32

Condenser lens

34

Projector lens

9

Lens barrel

[Fig. 4]

41

Detection circuit

43

Motor drive circuit

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Intl. Cl.

Identification mark

Office filing number FI

7316-2K

G03B 3/00

Fig.1

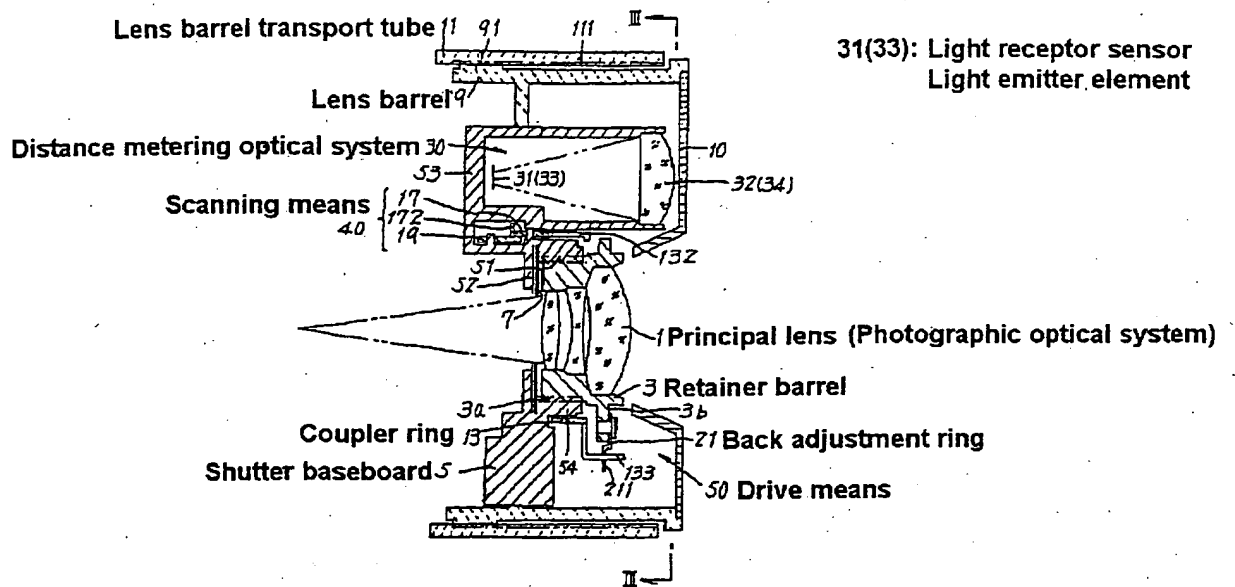


Fig.2

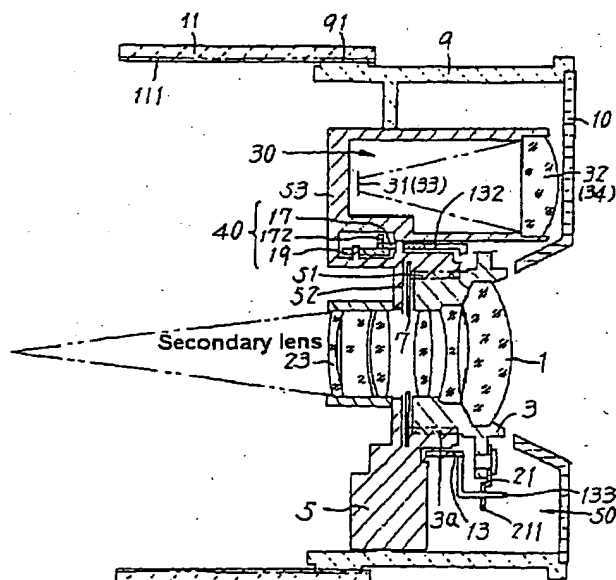


Fig.3

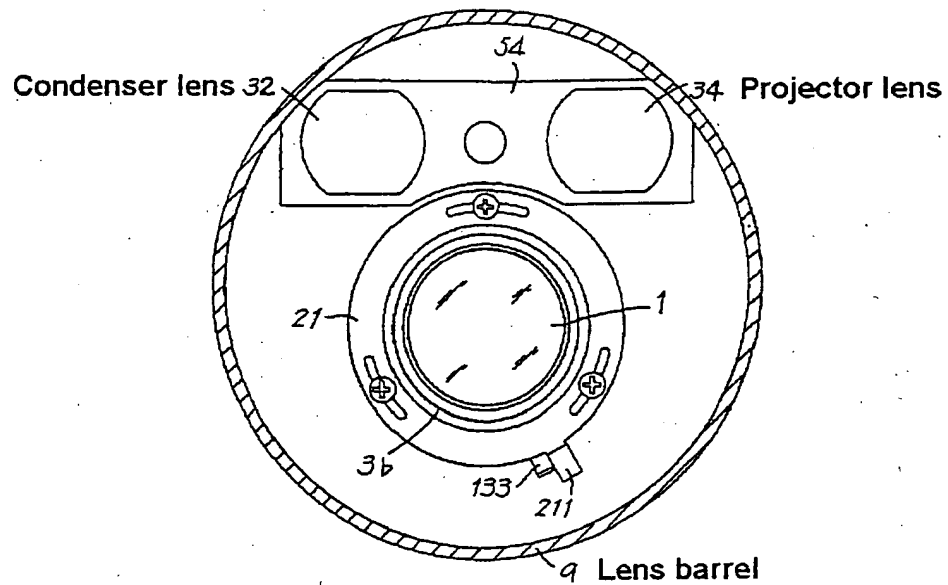


Fig.4

